Complementary feeding practices among children under two years old In West Africa: A review

Mitchodigni, I.M.

2018

Mitchodigni , I M , Hounkpatin , W A , Ntandou-Bouzitou , G , Termote , C , Bodjrenou , F S U , Mutanen , M & Hounhouigan , D J 2018 , ' Complementary feeding practices among children under two years old In West Africa: A review ' , African Journal of Food, Agriculture, Nutrition and Development , vol. 18 , no. 2 , pp. 13541-13557 . https://doi.org/10.18697/ajfand.82.17350

http://hdl.handle.net/10138/299722
https://doi.org/10.18697/ajfand.82.17350

publishedVersion

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 2
August 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2018; 18(2): 13541-13557 DOI: 10.18697/ajfand.82.17350

COMPLEMENTARY FEEDING PRACTICES AMONG CHILDREN UNDER TWO YEARS OLD IN WEST AFRICA: A REVIEW

Mitchodigni IM[1*], Amoussa Hounkpatin W[1], Ntandou-Bouzitou G[2], Termote C[3], Bodjrenou FSU[1], Mutanen M[4] and DJ Hounhouigan[1]

Irène Médémè Mitchodigni

*Corresponding author email: irenemedeme@gmail.com

[1] University of Abomey-Calavi, Abomey-Calavi, Bénin

[2] Bioversity International, Abomey-Calavi, Bénin

[3] Bioversity International, Nairobi, Kenya

[4] University of Helsinki, Helsinki, Finland

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 2
August 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

The burden of child malnutrition is still high in West African countries with 19.2 million stunted children and increases rapidly during the weaning period. This has been attributed to inappropriate complementary feeding practices. To our knowledge, few studies have tried to review the state of complementary feeding in the sub-region. This review aimed to provide an overview of current complementary feeding practices in West Africa in order to identify issues that should be targeted for ensuring optimal infant and young child nutrition. Articles and reports published from 2006 to 2016 were selected and reviewed. All documents were accessed through PubMed, Google scholar, and FreeFullPDF databases. Relevant and current documents focused on infant and young child (IYC) feeding from World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) were identified by using electronic searches via the Google platform. Complementary feeding practices are suboptimal in West Africa compared to the Northern Africa. Porridges and family dishes are the two main categories of complementary foods given to children and there are nutritionally inadequate. Enriched flours have been developed by using local diversity of food resources and improved food process like dehulling, fermentation, germination, malting, but their use remains low. Socio-economic, cultural and geographical factors were the determinants influencing IYC feeding practices at mother and household levels. Besides food availability, social, cultural, economic and geographic determinants were interrelated in a complex way to affect child feeding practices. This paper contributes to a much-needed evidence-based focus on the state of complementary feeding practices. As a key component to child survival, the improvement of complementary feeding has been shown to be the most effective in enhancing child growth and reducing stunting. Stakeholders such as policy and decision-makers, development partners, the private sector, and Non-Governmental Organizations should develop strategies for making enriched flours and nutritionally dense foods more accessible and affordable. Nutritional interventions should emphasize the promotion of adequate complementary feeding practices including feeding frequency, quality and quantity of diet and food safety in order to reduce malnutrition. Ongoing national plans and strategies for optimal IYC feeding should be encouraged to reduce child malnutrition.

Key words: complementary feeding, practices, determinants, nutrition plans, West Africa

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

INTRODUCTION

The increase in infant malnutrition in sub-Saharan Africa during the weaning period has been attributed to inappropriate complementary feeding practices and is responsible for half of the child mortality cases (2.9 million out of 5.9 million) [1]. West Africa region reported that 31.4 % of children under five were stunted, while 8.5 % were wasted [2]. Stunting is a huge burden for nations, which will result in future citizens that will neither be as healthy nor as productive as they should be [3]. Indeed, optimal nutrition in the first two years of life is crucial to laying the foundation of good nutrition and health for human wellbeing [4]. According to the World Health Organization (WHO), it is recommended to practice exclusive breastfeeding (EBF) during the first six months of an infant's life, followed by timely introduction of complementary foods (CFs) while continuing breastfeeding until two years of age to ensure optimal development during childhood [5]. Early or late introduction of CFs, inappropriate feeding frequency, inadequate nutrient density and food contamination characterize the suboptimal feeding practices which make children more vulnerable to irreversible effects of malnutrition, making them more susceptible to infectious diseases particularly during the first 1,000 days of life [6]. Growth faltering in particular is often widespread as soon as CFs are introduced because of the low nutrient density of most traditional complementary diets [7]. In addition to breastfeeding, optimal complementary feeding should be the key objective of a global strategy to ensure the nutrition security of infants and young children aged 6 to 23 months.

Until now, over the last 10 years, considerable global and national efforts have been devoted to breastfeeding promotion, but unfortunately, the same does not apply to complementary feeding [5,8]. This review aims to provide an overview of current complementary feeding practices in West Africa and identify issues and determinants that need to be addressed in order to ensure optimal infant and young child (IYC) nutrition.

METHODS

This paper is an analytical review based on quantitative and qualitative data. A search was conducted on PubMed, Google Scholar and FreeFullPDF databases. The search strategy was based on the population, interventions, comparison and outcomes (PICO) framework [9-11].

The search syntax was built using the following key words: (Child OR Children OR Kids OR Kid OR Infant OR Infants OR Toddler OR Toddlers OR Young child OR Young children OR Childhood OR Baby OR Babies) and (Complementary foods OR Complementary food OR Feeding practices OR Complementary feeding OR Supplementary food OR Supplementary foods OR Weaning OR Weaning food OR Breastfeed* OR Breastfed OR Porridge OR Milk OR Blend*) and (Benin* OR "Burkina Faso" OR Burkinabe OR "Cape Verde" OR "Cape Verdean" OR "Côte d'Ivoire" OR "Republic of Ivory Coast" OR Ivorian OR Gambia* OR Ghana* OR "Guinea" OR "Guinea-Bissau" OR Liberia* OR Mali* OR Mauritania* OR Mauritian OR Niger* OR Nigeria* OR Senegal* OR "Sierra Leone" OR "Sierra Leonean" OR Togo*).

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 2
August 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

The main criteria for inclusion of selected papers were: a) relevance to complementary feeding in West Africa and b) free accessibility and being downloadable. On the other hand, articles were excluded if they: i) were not relevant to the topic or keywords or ii), were a duplication of already included information and data. Articles written in English or French were considered. The period of the search covered 2006 to 2016. In addition, relevant and current documents focused on IYC feeding from WHO and the United Nations Children's Fund (UNICEF) were identified by using electronic searches via the Google platform [1,12,13]. National nutrition action plans or strategies existing in West African countries were also explored.

The review process was performed in three steps. First, titles of all articles were critically screened in order to ensure that they were linked to the study topic. Second, for the papers that remained in the sample based on the title, the abstracts were screened. Finally, the full texts of the selected papers were reviewed to compile and analyse the results. The search strategy took into account the scientific quality of the papers in order to obtain rigorous evidence-based. From the 485 documents originally found using the above syntax and keywords, 68 documents with relevant titles were retained. Subsequent abstract screening allowed for the final selection of 37 papers relevant for the review (Figure 1).

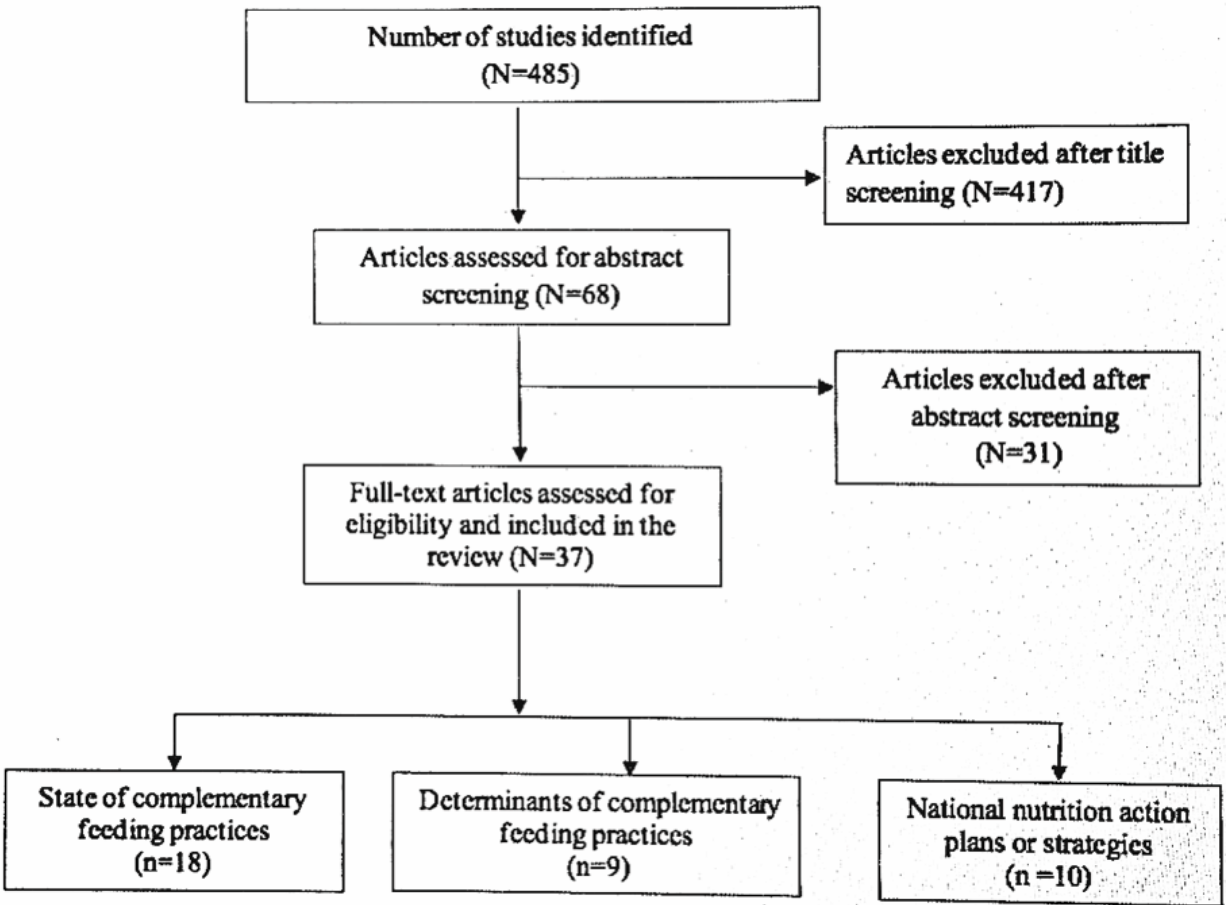

Figure 1: Search flow diagram of publications related to complementary feeding practices in West Africa

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

RESULTS AND DISCUSSION

Complementary feeding practices in West African countries

Timing of the introduction of complementary foods

Premature and late introductions of complementary foods appear to be important concerns since they are widely observed inadequate infant feeding practices in many West African countries (Figure 2). According to the recent UNICEF report State of the World's Children, less than 60% of children 6 to 8 months old were introduced to solid, semi-solid or soft foods in Burkina Faso, Mauritania, Gambia, Liberia and Guinea [1]. Benin, Ghana and Guinea-Bissau were countries where the timely introduction of CFs was better, with proportions of children 6 to 8 months old having been introduced CFs estimated beyond 70%. A study on Nigerian children found that 53.8% had premature initiation of CF while 5.1% had delayed initiation of CF [14]. Other studies, in Mali and Senegal, revealed early introduction of CFs as a poor infant feeding practice [15,16] .

The prevalence of malnutrition remains high with poor child feeding practices. It appears that suboptimal complementary feeding practices remain one of the major causes of child malnutrition and mortality in West Africa[17]. Concerning the time of initiation of complementary feeding, complementary foods introduced too early or too late was the main impediment to exclusive breastfeeding (EBF) [14]. The inappropriate age of introduction of CFs remains a challenge that significantly hampers optimal child growth and development. Early introduction of CFs (before six months old) could reduce the consumption of breast milk and increase the risk of iron and zinc deficiencies and infectious diseases such as diarrhoea, pneumonia, measles, malaria, respiratory illness [18] , which further contributes to impaired growth and health disorders[7]. In an attempt to resolve stomach pains and to prevent diseases, water and herbal tea are the first liquids introduced in the first three months of life [16,19]. Poor knowledge, misconceptions of the mothers and traditional beliefs are factors that contribute to inappropriate complementary feeding practices [20]. The greater the frequency of prenatal clinic visits, the more often mothers respect the timely introduction of CFs through appropriate counselling from health workers. Hence, health facility access appears essential for enhancing good infant feeding practices [5].

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 2
August 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

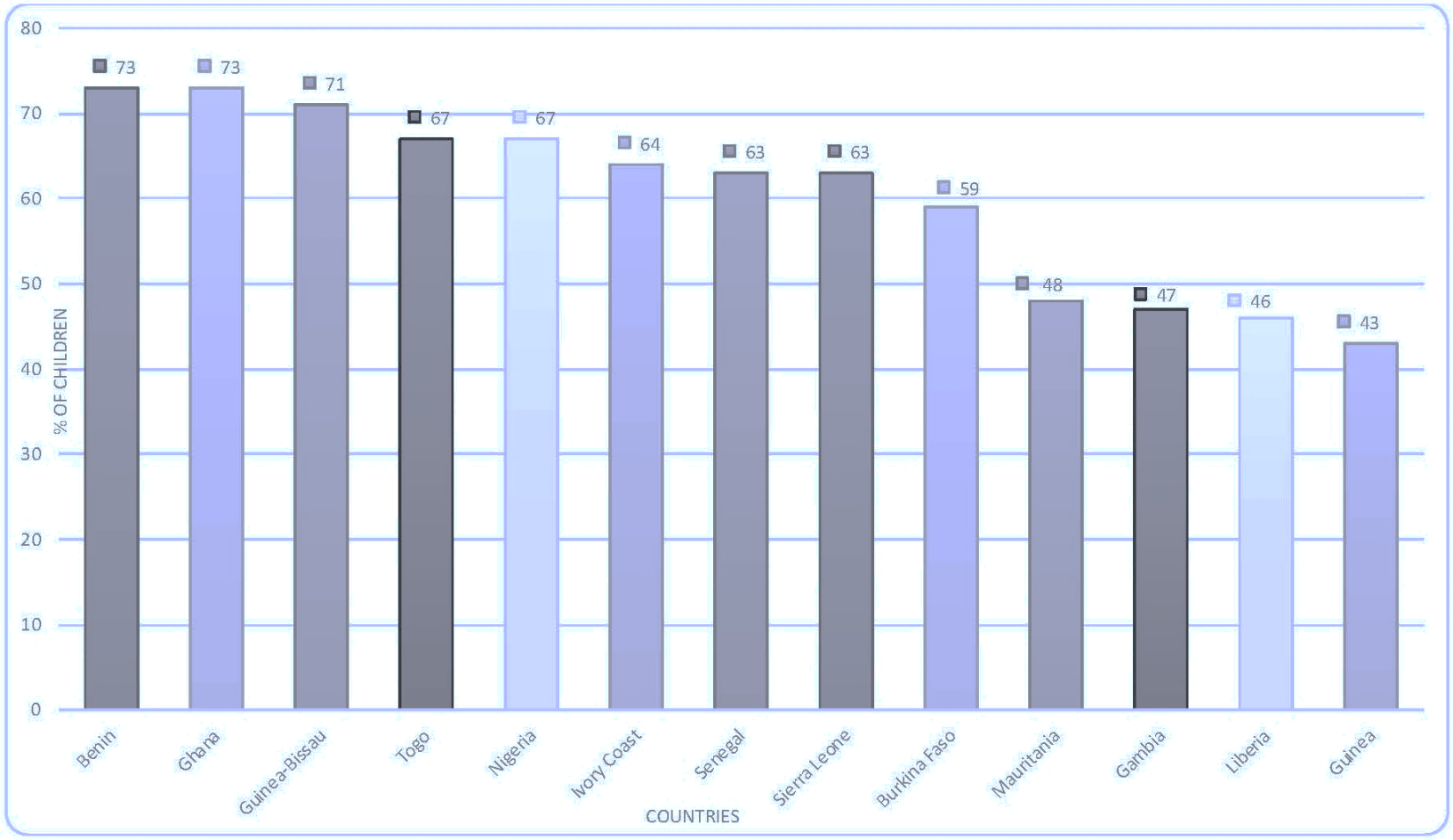

Figure 2: Percentage of children 6 to 8 months old having been introduced to solid, semi-solid or soft foods in West African countries / Data source: (UNICEF, 2016)

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Types of complementary foods and overview of enriched flours developed

Protein deficiency in the diet is common and usually associated with unsuitable micronutrients in the West Africa region [21]. Complementary feeding should begin with incremental increases in food quantity because of the limited gastric capacity of children, which gradually increases as they grow older [22]. In the African context, foods given during the complementary feeding period (6 to 23 months) consist of 1) "transitional" foods which are essentially porridges, and 2) family dishes, most often made of staple foods with sauce [19, 23-25]. Porridges are the most common and first CFs given to children, followed by family dishes, in West African countries [24,25]. In Burkina Faso, findings have categorized CFs into three types: porridges, family dishes (most often a paste made of cereals accompanied with sauce) and special dishes (any dish other than porridge that is cooked specially for a child), while two similar categories (porridges and mashed family dishes) have been reported in Senegal [16,19].

With regards to the quality of CFs, porridges mostly consisting of cereals are nutritionally poor [26]. Indeed, porridges, often called "Koko" or "Pap", are usually made of starchy foods, which confer thick and gelatinous foods with a low nutrient content [27, 28]. Typically, the first foods introduced lack calories, especially the watery porridges given to infants. Porridges contain 80-90% water and the dry matter (10-20%) is predominated by starch with a very low proportion of other nutrients (proteins and micronutrients). Therefore, watery CFs may contain approximately 0.3 kcal/g, which is way below the recommended 0.8 kcal/g [5]. According to mothers' perceptions, it is easier for children to digest a diluted food [24]. Although the child has filled their stomach, the low energy content of the food is not likely to satisfy their energy requirements. As a result, children are at risk of malnutrition during the complementary feeding period. In other words, these foods often lack protein or appropriate micronutrients such as iron, vitamin A, zinc and iodine, according to secular trends in complementary feeding indicators [14,29]. A low quality diet provided to children contributes to the high risk of stunting during early life [6]. Appropriately nutritive complementary feeding is also important in helping improve the gastric capacity of children around weaning time. Thus, several studies have been implemented on porridge prepared with fortified flours using locally available food resources. Table 1 gives an overview of the characteristics of some enriched flours formulated in the countries covered by this review. Three main food groups are used to formulate enriched flours: cereals (maize, rice and millet), roots and tubers (sweet potato), legumes and nuts (cowpeas, soybean and groundnuts) and flesh foods (dried or smoked fishes). No enriched flours based on roots or nuts have been found in the countries of interest. Enriched flours are generally composed of 65 to 80% of foods from cereals, roots and tubers groups; 10 to 35% from the legumes group; 0 to 17% from the flesh foods; and in rare cases, some leafy vegetables (up to 10%). For instance, local dietary resources like moringa (*Moringa oleifera)* leaves, African locust bean *(Parkia biglobosa)* kernels, Baobab *(Adansonia digitata)* leaves and fruits are increasingly being used in the formulation of infant flours [30].

Determinants of suboptimal complementary feeding practices

In light of studies covering 2006 to 2016 period, untimely introduction of foods, inadequate quantity and quality of diets provided to children and social environment were the main determinants of suboptimal complementary feeding practices identified. Figure

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

3 shows a complex interaction of factors associated with suboptimal complementary feeding practices. Socio-economic, cultural and geographical factors were the main determinants that influenced IYC feeding practices at mother and household levels [31-33]. Local perceptions that breast milk alone is inadequate for the growth and survival of the baby were identified through the following beliefs: "*insufficient breast milk*" and "*continuous crying by baby*", "*the number of teeth the child had*" and "*desire of the child to eat*" [34]. Moreover, maternal educational level and women's competing household responsibilities were associated with suboptimal complementary feeding practices. At the household level, poverty and geographic location negatively influenced child feeding practices [31,33].

Besides food, social, cultural, economic and geographic determinants were interrelated in a complex way to affect child feeding. For instance, in Nigeria, the odds of meeting the minimum acceptable diet (MAD) were higher among more educated, wealthier mothers who also made frequent antenatal visits [29].

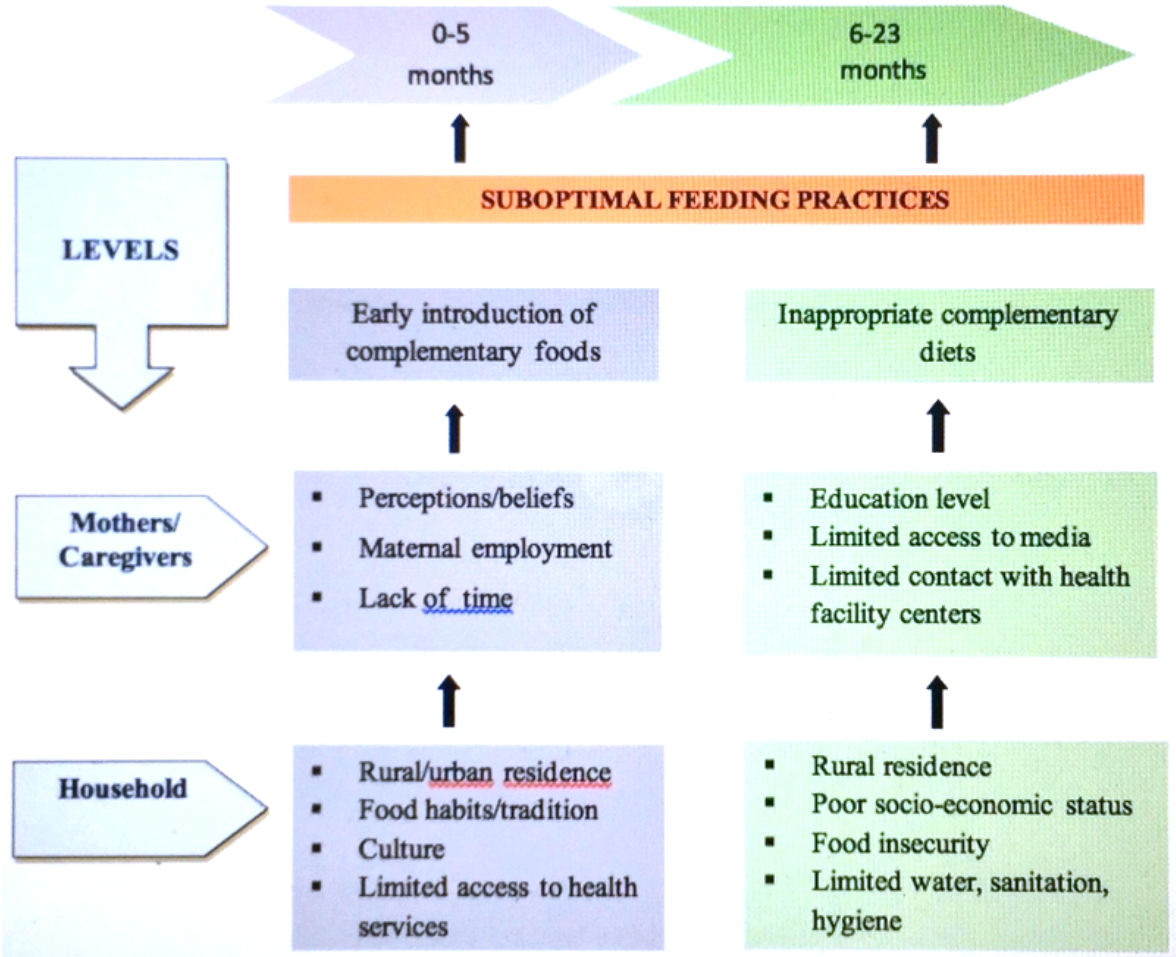

Figure 3: Framework of determinants of suboptimal complementary feeding in West Africa (Adapted from Ogbo *et al.* [29],Issaka *et al.* [31],Issaka *et al.* [32],Yarnoff *et al.* [33], Gupta *et al.* [16])

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Strengths and opportunities for improved local foods

Enriched flours made from locally available ingredients are a great opportunity to improve the nutrient composition of porridges in order to ensure adequate complementary feeding in resource-poor countries [35]. Flour production often involves the use of operations like de-hulling, soaking, fermentation, and malting [15,21,36]. When the meal preparation was carried out with Good Hygienic Practices and Good Manufacturing Practices, these operations have been shown to improve the nutritional quality and safety of CFs, as well as the bioavailability of nutrients, by reducing the levels of polyphenols and phytic acid [15,21,36]. Indeed, fermentation contributes to reducing the risk of microbial contamination in homemade CFs [15]. Moreover, fermentation can improve the food quality by enhancing the availability of some micronutrients like vitamins and by reducing phytates [36]. Unfortunately, until now, these formulated flours have been underutilized for complementary feeding [37].

Improving complementary feeding practices within national nutrition plans or strategies

As a key component to child survival, the improvement of complementary feeding has been shown to be the most effective in enhancing child growth and health [5]. It appeared through the review that few countries in the West African region have specifically focused on strategies and actions to enhance complementary feeding practices. Burkina Faso and Benin are examples of such countries.

In Benin, the strategic plan for food and nutrition development (*Plan Stratégique de Développement de l'Alimentation et de la Nutrition* "PSDAN") has been designed and considers IYC feeding to be a priority component through the "Short route", which is implemented through the Multi-sectorial Project of Food, Health and Nutrition (*Projet Multisectoriel de l'Alimentation, de la Santé et de la Nutrition* "PMASN") [38]. This programme outlines specific activities to address optimal IYC feeding practices, including the following areas of development of nutritional and dietary guidelines: valorization of nutritious and ready-to-use local foods; promotion of family and school gardens; conception of behaviour change communication tools for alimentation, health and nutrition; scaling up the Nutrition-Friendly School Initiative; and promotion of affordable and minimally time-consuming CFs in collaboration with the private sector [39]. With regard to Burkina Faso's national plan for scaling up optimal IYC feeding practices promotion (2013-2025), the following activities were outlined: training health and early childhood professionals; institutionalization of the Integrated Services Package for Child Feeding (*Paquet Intégré des Services d'ANJE* "PISA") at the public and private health facility level; integration of IYC best feeding practices as a planning objective in social protection interventions; promotion of access to enriched flours in households; and promotion of ready-to-eat enriched porridges through kiosks in vulnerable areas [40].

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

CONCLUSION

In conclusion, complementary feeding practices were suboptimal in West African countries at the time of this review. The untimely introduction of foods and inadequate quantity and quality of diets provided to children were the main issues. Besides food, social, cultural, economic and geographic determinants were interrelated in a complex way to affect child-feeding.

To guarantee the nutritional wellbeing of children, a holistic approach with a narrow focus on the first 1000 days of life is required. Stakeholders such as decision-makers in health and nutrition, technical and financial partners, private sector, and Non-Governmental Organizations should develop strategies for making enriched flours and nutritionally dense foods more accessible and affordable in rural areas. in order to sustainably optimize child feeding. Improving vegetable consumption is also an opportunity to improve the quality of child dietary patterns. Moreover, increased awareness of new evidence within information networks would help to update the decision support tools. Nutritional interventions should emphasize the promotion of adequate complementary feeding practices including feeding frequency, quality and quantity of diet and food safety in addition to breastfeeding. Ongoing national plans and strategies focusing on optimal IYC feeding should be encouraged to reduce child malnutrition.

Limitation of this review

The inaccessibility of few articles could have limited the deep analysis of infant and young feeding practices in certain countries even if the UNICEF's report in 2016 has covered a little bit of this gap [1]. This study was unable to address the cost aspects of new improved recipes, which would have helped to appreciate the financial implications of the use of certain enriched flours in rural areas.

Declaration of Conflict of interest

The authors declare that they have no competing interests.

ACKNOWLEDGEMENTS

The author(s) received the following financial support for the research, authorship and/or publication of this article: This work was funded by Bioversity International which implements the **FoodAfrica Programme-Work Package 4 "Enhancing food and nutrition security".** FoodAfrica Programme's main funding agency is the Ministry for Foreign Affairs of Finland. We thank Mrs. Sherifath MAMA from University of Abomey-Calavi/ "Ecole de Nutrition et des Sciences et Technologies Alimentaires" for capacity building through PICO method during search strategy.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 1: Characteristics of enriched flours or recipes developed as complementary foods in West African countries

Authors	Countries	Type of complementary food	Details of ingredients	Main characteristics
[25]	BENIN	Blend of cereals and legumes	- Maize (65%) - Bean (20%) - Peanut (15%)	- Nutrients components: 69.3% carbohydrates, 15.1% proteins, 10.7% lipids, less than 5% crude fibre. - Flour energy density: 4.34 kcal/g - Porridge energy density: 0.81 kcal/g
[41]	BENIN	Blend of cereal and wild fruit	- Cereals: Maize or Millet or Sorghum - Baobab pulp	Nutrients components: Fat: 0.7g/100g (unfermented) – 1.6g/100g (fermented)
[35]	BURKINA FASO	Blend of cereals, vegetable seeds and wild fruits powder	Three formulae (one cereal with other ingredients): F1 (maize); F2 (millet), F3 (rice) Cereals Maize (*Zea mays*) Millet (*Pennisetum glaucum*) Rice (*Oryza sativa*) Other local ingredients *Adansonia digitata* (pulp) *Parkia biglobosa* (pulp) *Cucurbita maxima* (seeds) *Moringa oleifera* (seeds)	F1, F2, F3 contain respectively: - Fat: 15.91±0.01%, 11.82±0.02%, 17.02±0.02% - Carbohydrates: 65.45±0.06%, 70.81±0.01%, 64.51±0.01% - Energy value (kcal/100g): 453.07±0.05, 424.56±0.03, 458.96±0.05
[42]	GHANA	Weaning food	Cowpea: 47% Ripe banana: 40% Peanut: 13%	- Nutrients components: 68% carbohydrates, 16.9% proteins, 8.4% lipids

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Authors	Countries	Type of complementary food	Details of ingredients	Main characteristics
[43]	GHANA	Blend of tuber, legume and fish flour	Sweet potato flour: 66% Full-fat soybean: 10% Soybean oil: 6% Fish flour: 17% Iodised salt: 0.5% Granulated white sugar: 0.5%	This blend has a double advantage over cereal-legume blends to improve the vitamin A status and enhance iron absorption
[15]	MALI	Enriched porridges	A. Millet porridge enriched with baobab fruit powder and peanut powder - 2 scoops de-hulled millet powder - 1 scoop baobab fruit powder - ½ scoop peanut powder - Salt (a pinch) & Sugar (1 tablespoon) B: Rice porridge enriched with milk and sesame powder - 1 coffee cup polished rice - 1 coffee cup milk - ½ scoop sesame powder - 2 tablespoons red palm oil - Salt (a pinch) & Sugar (1 tablespoon) C. Sorghum porridge enriched with peanut powder and baobab fruit powder - 2 scoops de-hulled sorghum flour - 4 tablespoons peanut powder - 2 tablespoons baobab fruit powder - 2 tablespoons red palm oil	A, B, C contain respectively Energy (kcal): 1946, 1293, 2094 Proteins (g): 53, 26, 54 Fat (g): 49, 86, 91 Carbohydrate (g): 239, 105, 38 Vitamin A (µg): 38, 462, 423 Calcium (mg): 473, 984, 304 Iron (mg): 41, 7, 26 Zinc (mg): 11, 3, 11

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Authors	Countries	Type of complementary food	Details of ingredients	Main characteristics
			- Salt (a pinch) & Sugar (1 tablespoon)	
[30]	NIGERIA	Blend of cereal, legume and moringa leaves	❖ Control blend - Maize: 60% - Soybean: 40% ❖ Test blend - Maize: 60% - Soybean: 30% - *Moringa leaves* powder: 10%	Control blend: Protein: 11.36%; Carbohydrate: 55.73% Test blend: Protein: 15.15%, Carbohydrate: 47.15%
[44]	NIGERIA	Blend of cereal, tuber and fruit powder	- Control sample: Sorghum 100% (traditional weaning food) - Formulated sample: Sorghum, African yam bean (*Sphenostylis stenocarpa*), Mango mesocarp flour: ratio 5:3:2	- A significant ($p<0.05$) increase in the protein and fat levels of the formulated complementary food (Sorghum African yam Mango): (8.9±1.09 to 17.4±1.19% and 1.5±0.11 to 3.5±0.31%), respectively - A significant ($p<0.05$) decrease in the carbohydrate levels (78±1 to 67.59±1.35) - Vitamin A of SAM: 3.54µg/mg - Energy density: Control sample (5.04 kcal/g); Formulated sample (3.08 Kcal/g)

REFERENCES

1. **UNICEF.** The state of the world's children 2016. A fair chance for every child. UNICEF, New York. 2016.

2. **WHO**. Global and regional trends by UN Regions, 1990-2025. Stunting:1990-2025 2017. Available from: apps.who.int/gho/data/View.main.NUTUNSTUNTINGv?lang=en. Accessed 22nd June 2017.

3. **UNICEF** Improving child nutrition. The achievable imperative for global progress. UNICEF, New York. 2013.

4. **Steve IO and OI Babatunde** Chemical compositions and nutritional properties of popcorn-based complementary foods supplemented with Moringa oleifera leaves flour. *Journal of Food Research*. 2013; **2**:117.

5. **WHO.** Infant and young child feeding. Model chapter for textbooks for medical students and allied health professionals. WHO, Geneva. 2009.

6. **Shrimpton R, Victora CG, de Onis M, Lima RC, Blössner M and G Clugston** Worldwide timing of growth faltering: implications for nutritional interventions. *Pediatrics*. 2001; **107**:e75-e.

7. **Dewey KG, Peerson JM, Heinig MJ, Nommsen LA, Lonnerdal B, Lopez de Romana G, de Kanashiro HC, Black RE and KH Brown** Growth patterns of breast-fed infants in affluent (United States) and poor (Peru) communities: implications for timing of complementary feeding. *Am J Clin Nutr*. 1992; **56**:1012-8.

8. **Pan American Health Organization and World Health Organization** Guiding principles for complementary feeding of the breastfed child. PAHO/WHO, Washington DC. 2003.

9. **Richardson WS, Wilson MC, Nishikawa J and RS Hayward** The well-built clinical question: a key to evidence-based decisions. *ACP journal club*. 1995; **123**:A12-A.

10. **Ho GJ, Liew SM, Ng CJ, Shunmugam RH and P Glasziou** Development of a Search Strategy for an Evidence Based Retrieval Service. *PloS one*. 2016; **11**:e0167170.

11. **Agoritsas T, Merglen A, Courvoisier DS, Combescure C, Garin N, Perrier A and TV Perneger** Sensitivity and predictive value of 15 PubMed search strategies to answer clinical questions rated against full systematic reviews. *Journal of medical Internet research*. 2012; **14.**

12. **WHO.** Indicators for assessing infant and young children feeding practices. Part I. Definitions. World Health Organization, Geneva. 2008.

13. **WHO and UNICEF.** Baby-friendly hospital initiative: revised, updated and expanded for integrated care. World Health Organization, Geneva. 2009.

14. **Ogunlesi TA, Ayeni VA, Adekanmbi AF and BM Fetuga** Determinants of timely initiation of complementary feeding among children aged 6-24 months in Sagamu, Nigeria. *Nigeria, Journal of clinical practice*. 2014; **17**:785-90.

15. **Ag Ayoya M, Kodio J, Ag Iknane A and R Sodjinou** Nutritional value of locally produced foods and potential for developing age-appropriate complementary foods for children under 2 years of age in Mali. *Food and nutrition bulletin*. 2010; **31**:391-9.

16. **Gupta N, Gehri M and N Stettler** Early introduction of water and complementary feeding and nutritional status of children in northern Senegal. *Public health nutrition*. 2007; **10**:1299-304.

17. **Idris S, Popoola-Zakariyya B, Sambo M, Sufyan M and A Abubakar** Nutritional Status and Pattern of Infant Feeding Practices among Children under Five in a Rural Community of Northwestern Nigeria. *International Quarterly of Community Health Education*. 2013; **33**:83-94.

18. **Gyampoh S, Otoo GE and RN Aryeety** Child feeding knowledge and practices among women participating in growth monitoring and promotion in Accra, Ghana. *BMC Pregnancy and Childbirth*. 2014; **14.**

19. **Sawadogo SP, Yves M-P, Claire M-R, Alain B, Alfred TS, Serge T and D Francis** Late introduction and poor diversity were the main weaknesses of complementary foods in a cohort study in rural Burkina Faso. *Nutrition*. 2010; **26**:746-52.

20. **Egyir BK, Ramsay SA, Bilderback B and S Safaii** Complementary Feeding Practices of Mothers and Their Perceived Impacts on Young Children: Findings from KEEA District of Ghana. *Maternal and Child Health Journal*. 2016; **20**:1886-94.

21. **Onoja U, Akubor P, Gernar D and C Chinmma** Evaluation of Complementary Food Formulated from Local Staples and Fortified with Calcium, Iron and Zinc. *J Nutr Food Sci*. 2014; **4**:2.

22. **Dewey KG and KH Brown** Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs. *Food and Nutrition Bulletin*. 2003; **24**:5-28.

23. **Nelson-Quartey F, Amagloh F, Oduro I and W Ellis** Formulation of an infant food based on breadfruit (Artocarpus altilis) and breadnut (Artocarpus camansi). *International Symposium on Breadfruit Research and Development*. 2007; **757:**215-24.

24. **Ukegbu PO and JU Anyika** Chemical analysis and nutrient adequacy of maize gruel (PAP) supplemented with other food sources in Ngor-Okpala Lga, Imo state, Nigeria. *Journal of Biology, Agriculture and Healthcare*. 2012; **2**:13-21.

25. **Dossa RA, Ahouandjinou ERT and FE Houngbe** Evaluation of the suitability and acceptability of a newly designed infant flour for infant feeding in the district of Bopa in south of Benin. *AJFAND*. 2011; **11**:4934-52.

26. **Issaka AI, Agho KE, Page AN, Burns PL, Stevens GJ and MJ Dibley** The problem of suboptimal complementary feeding practices in West Africa: what is the way forward? *Maternal and Child Nutrition*. 2015; **11**:53-60.

27. **Abasiekong KS, Akubundu ENT and E Oti** Chemical, sensory and biological evaluation of maize-bambaranut based complementary foods. *Nigerian Food Journal* 2010; **28** 25-31.

28. **Olaitan NI, Eke MO and EM Uja** Quality evaluation of complementary food formulated from *Moringa oleifera* leaf powder and pearl millet (*Pennisettum glaucum*) flour. *IJES*. 2014; **3**:59-63.

29. **Ogbo FA, Page A, Idoko J, Fernanda C and KE Agho** Trends in complementary feeding indicators in Nigeria, 2003-2013. *BMJ Open*. 2015; **5:e008467.**

30. **Nwosu OIC, Nnam NN, Ibeziako N and AN Maduforo** Development and nutrutional evaluation of infant complementary food from maize (*Zea mays*), soybean (*Glycine max*) and *Moringa oleifera* leaves. *International Journal of Nutrition and Food Sciences*. 2014; **3**:290-9.

31. **Issaka AI, Agho KE, Page AN, Burns PL, Stevens GJ and MJ Dibley** Determinants of suboptimal complementary feeding practices among children aged 6-23 months in seven francophone West African countries. *Maternal and Child Nutrition*. 2015; **11**:31-52.

32. **Issaka AI, Agho KE, Page AN, Burns PL, Stevens GJ and MJ Dibley** Determinants of suboptimal complementary feeding practices among children aged 6-23 months in four anglophone West African countries. *Maternal and Child Nutrition*. 2015; **11**:14-30.

33. **Yarnoff B, Allaire B and P Detzel** Mother, infant and household factors associated with the type of food infants receive in developing countries. *Frontiers in Pediatrics*. 2014; **2.**

34. **Ukegbu AU, Ukegbu PO, Onyeonora UU and CF Ubajaka** Determinants of breastfeeding patterns among mothers in Anamba State, Nigeria. *SA Journal of Child Health*. 2011; **5**:112-6.

35. **Compaoré WR, Nikièma PA, Bassole HIN, Savadogo A, Hounhouigan JD, Mouecoucou J and SA Traoré** Nutritional Properties of Enriched Local Complementary Flours. *Advance Journal of Food Science and Technology*. 2011; **3**:31-9.

36. **Kayode APP, Akogou FUG, Amoussa-Hounkpatin W and JD Hounhouigan** Effets des procédés de transformation sur la valeur nutritionnelle des formulations de bouillies de complément à base de sorgho. *Int J Biol Chem Sci*. 2012; **6**:2192-201.

37. **Kouton SE, Amoussa Hounkpatin W, Ballogou VY, Lokonon JH and MM Soumanou** Caractérisation de l'alimentation des jeunes enfants âgés de 6 à 36 mois en milieu rural et urbain du Sud–Bénin. *Journal of Applied Biosciences*. 2017. **110**:10831-40.

38. **République du Bénin** Plan stratégique de développement de l'alimentation et de la nutrition. Partie B. Benin: Banque Mondiale & Core Group 2009.

39. **World Bank and International Development Association** BENIN Multisectorial Food Health Nutrition Project. FTHW Country Department AFCFI Africa Region: World Bank & International Development Association2014.

40. **Burkina Faso** Plan de passage à l'échelle de la promotion des pratiques optimales d'alimentation du Nourrisson et du Jeune Enfant au Burkina Faso (2013-2025). Burkina Faso: Ministère de la Santé 2014.

41. **Chadare FJ, Gayet DP, Azokpota P, Nout MJR, Linnemann AR, HOUNHOUIGAN JD and MAJS van Boekel** Three traditional fermented baobab foods from Benin, Mutchayan, Dikouanyouri and Tayohounta: Preparation, Properties and consumption. *Ecology of Food and Nutrition*. 2010; **49**:279-97.

42. **Bassey FI, Mcwatters KH, Edem CA and C Iwegbue** Formulation and nutritional evaluation of weaning food processed from cooking banana, supplemented with cowpea and peanut. *Food Science and Nutrition*. 2013; **1**:384-91.

43. **Amagloh FK, Brough L, Weber JL, Anthony N M, Allan H and C Jane** Sweetpotato-based complementary food would be less inhibitory on mineral absorption than a maize-based infant food assessed by compositional analysis. *International Journal of Food Sciences and Nutrition*. 2012; **63**:957-63.

44. **Yusufu PA, Egbunu FA, Egwujeh SID, Opega GL and MO Adikwu** Evaluation of Complementary Food Prepared from Sorghum, African Yam Bean (*Sphenostylis stenocarpa*) and Mango Mesocarp Flour Blends. *Pakistan Journal of Nutrition*. 2013; **12**:205-8.